

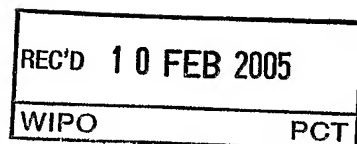


PCT/1805/50491



INVESTOR IN PEOPLE

The Patent Office  
Concept House  
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NP10 8QQ

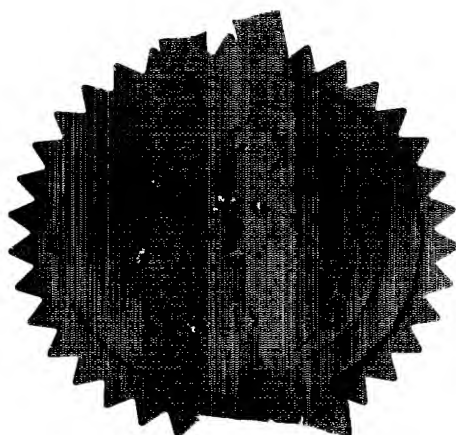


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Patents Form 1/77

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|----|--|--|---|----------------|
| 1. | Your reference   | PHGB040039GBQ  |   |                |
| 2. | Patent application number<br><i>(The Patent Office will fill in this part)</i>   | 0403128.2  |   |                |
| 3. | Full name, address and postcode of the or of each applicant <i>(underline all surnames)</i>  | KONINKLIJKE PHILIPS ELECTRONICS N.V.<br>GROENBWOUDSEWEG 1<br>5621 BA EINDHOVEN<br>THE NETHERLANDS<br>07419294001 ✓ |   |                |
|    | Patents ADP Number <i>(if you know it)</i>   |  |   |                |
|    | If the applicant is a corporate body, give the country/state of its incorporation  | THE NETHERLANDS  |   |                |
| 4. | Title of the invention   | MULTICAST TRANSMISSION   |   |                |
| 5. | Name of your agent <i>(if you have one)</i>  |  |   |                |
|    | "Address for service" in the United Kingdom to which all correspondence should be sent <i>(including the postcode)</i>   | Philips Intellectual Property & Standards<br>Cross Oak Lane<br>Redhill<br>Surrey RH1 5HA                           |   |                |
|    | Patents ADP number <i>(if you know it)</i>   | 08359655001 ✓  |   |                |
| 6. | If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and <i>(if you know it)</i> the or each application number   | Country  | Priority Application number               | Date of filing |
| 7. | If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application   | Number of earlier application  | Date of filing<br><i>(day/month/year)</i> |                |
| 8. | Is a statement of inventorship and of right to grant of a patent required in support of this request? <i>(Answer "Yes" if:</i><br>a) <i>any applicant named in part 3 is not an inventor, or</i><br>b) <i>there is an inventor who is not named as an applicant, or</i><br>c) <i>any named applicant is a corporate body.</i><br>See note (d)) | YES  |   |                |

Patents form 1

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Request for preliminary examination and  
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12/2/04

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## DESCRIPTION

## MULTICAST TRANSMISSION

5           The invention relates to a method of multicast transmission, to a system for multicast transmission, and to apparatus for use in a multicast transmission system.

10           The introduction of the Multimedia Broadcast Multicast Service (MBMS) in UMTS will enable the reliable transmission of shared data to a potentially very large number of recipients. In adverse radio channel conditions, it may be necessary to apply a retransmission scheme triggered by some feedback mechanism from the receivers, in order to reduce data loss and increase the performance.

15           Retransmission schemes for the reliable delivery of data in multicast i.e. point-to-multipoint configurations are under consideration in 3GPP. Such schemes usually imply the use of some form of feedback mechanism between the receivers (UEs) and the network (NodeB), which can result in a high  
20   amount of feedback signalling when the number of recipients is large. In particular, it is required that MBMS UEs must be able to request retransmission of failed packets from an MBMS session.

25           Possible existing uplink channels in UMTS which could be reused for the feedback include Dedicated Channels (DCH) and the Random Access Channel (RACH). The existing RACH is divided in a time-division manner into sets of Access Slots. Each set of Access Slots can be assigned to transmissions of a given priority level, known as an Access Service Class (ASC). Within each set of access slots, the UE chooses a random access slot  
30   and transmits a preamble using a randomly-selected signature to minimise the probability of collisions occurring due to different UEs choosing the same access slot and signature.

In order for a UE to indicate that it needs a retransmission or wants to fetch some missing data following erroneous reception, some form of feedback signalling is needed in an uplink physical channel between the UE and the NodeB to carry "on-demand" retransmission requests, usually taking the form of ACK ("positive" acknowledgment when the UE receives a multicast packet correctly, indicating no need to retransmit) or NACK ("negative" acknowledgement when the UE detects some packet error or loss, indicating a need or a request to retransmit that piece of data) feedback.

A simple way to implement a point-to-point retransmission through some dedicated feedback signalling in UMTS would be to use the DCH transport channel to carry feedback signalling in the uplink physical channel. This would however give rise to some problems:

- A huge increase in uplink traffic due to feedback signalling may occur when many individual UEs need retransmissions
- Some of the feedback signalling would be redundant when a number of UEs need and ask for retransmission of the same data
- Significant delay may occur while a DCH is set up.

In order to reduce the amount of uplink feedback signalling and interference arising from MBMS retransmission requests, this invention proposes to modify the RACH to make it suitable for use as a transport channel for MBMS feedback signalling.

According to the invention, a retransmission request message transmitted by a UE consists of 2 parts, the first part identifying the unit of MBMS data to be retransmitted, and the second part identifying the UE. Other information may also be included in either part of the message. An important aspect of the invention is that the transmission of the UE ID is optional, depending on whether a positive or a negative acknowledgement of the first part of the retransmission request is received from the Node B.

Although the original transmission was in broadcast mode (where the term "broadcast" is understood to include "multicast"), on receipt of a retransmission request the Node B makes a decision as to whether the retransmitted data should be transmitted in broadcast mode or dedicated mode, and determines accordingly what type of acknowledgement signal to transmit in response to the UEs' retransmission requests. If the Node B decides to use a broadcast transmission to retransmit the requested data unit, it transmits a first signal to the UEs which used the signature/access slot corresponding to that data unit to prevent those UEs from transmitting their IDs; alternatively, if the Node B decides to retransmit using dedicated channels, it transmits a second signal instructing those UEs to continue with the second part of their transmissions including their IDs. (Note that different approaches could be used for different groups of UEs in a cell.)

15

The decision between broadcast and dedicated modes (and hence between the first and second signals) may be based on an estimate of the number of UEs requesting retransmission of a particular data unit.

20

The estimate of the number of UEs may be derived from an estimate of the amount of received signal energy corresponding to a particular data unit, or the number of autocorrelation peaks.

The first signal may be a negative acknowledgement and the second signal may be a positive acknowledgement.

25

The first signal may be a positive acknowledgement and the second signal may be a negative acknowledgement.

30

The UE may format the first part of the message according to the following rules, which are designed to cause requests from different UEs for

retransmission of the same data unit to collide (in contrast to the normal RACH procedure which uses random functions to minimise the risk of collision):

Certain RACH access slots are designated specifically for MBMS use. This  
5 can be done for example by:

- defining a new Access Service Class specifically for MBMS feedback signalling (where the new Access Service Class would not be used by UEs which are not MBMS-capable), or
- defining a specific set of access slots as being reserved for MBMS  
10 feedback signalling; these access slots would not then be able to be allocated by the RNC for any of the non-MBMS ASCs.

The first of these methods gives greater flexibility to the network in configuring the access slots.

- 15 Within the defined access slots, specific combinations of access slot and/or signature may be used to indicate which packet(s) should be retransmitted.

The UE's behaviour on receipt of a positive or negative acknowledgement may be modified compared to the normal RACH procedure. Two possibilities are:

20

- a) If the UE receives a positive acknowledgement, it transmits the message part containing its UE ID. (This would enable the Node B to transmit the retransmission in dedicated mode.) If the UE receives a negative acknowledgement, it shall not transmit the message part. (In this case, the UE  
25 would expect the retransmission to be broadcast.)

- b) If the UE receives a positive acknowledgement, it does not transmit the message part (in contrast to the normal RACH procedure where receipt of a positive acknowledgement is the indication that the message part  
30 should be transmitted). (In this case, the UE would expect the retransmission to be broadcast.), If the UE receives a negative acknowledgement, it does not transmit the message part and further it shall not transmit another RACH



preamble using the access slot and signature corresponding to the same data unit, but should switch to a different ASC and transmit a conventional RACH message including the full message part. (In this case, the retransmission could be transmitted in dedicated mode after the conventional RACH message has been received by the Node B.)

Some advantages of the invention are:

- Efficiency of retransmissions is improved.
- If a large number of UEs are requesting retransmission of one particular packet, a high combined uplink power will be received in the relevant access slot with the relevant signature, enabling the Node B to terminate the RACH preamble power ramping quickly by transmission of the corresponding AICH message.
- Uplink interference is minimised by avoiding transmission of RACH message parts when large numbers of UEs require the same retransmission – i.e. when the most efficient means of retransmission is to use broadcast mode, when details of the UE IDs and the exact number of UEs requiring the retransmission are not required.
- The invention allows the Node B to select broadcast or dedicated modes for retransmissions in a manner appropriate to the situation.

In an embodiment of the invention, specific RACH access slots or groups of access slots can be allocated for MBMS feedback signalling for specific MBMS services or sessions.

One possible method of allocating specific UEs to specific RACH access slots or groups of access slots is by the quality of reception of UEs, separating UEs into groups according to quality metrics such as:

- $E_b/N_0$  over a predetermined time period
- the number or proportion of packets previously received successfully in a predetermined time window.

**PCT/IB2005/050491**

